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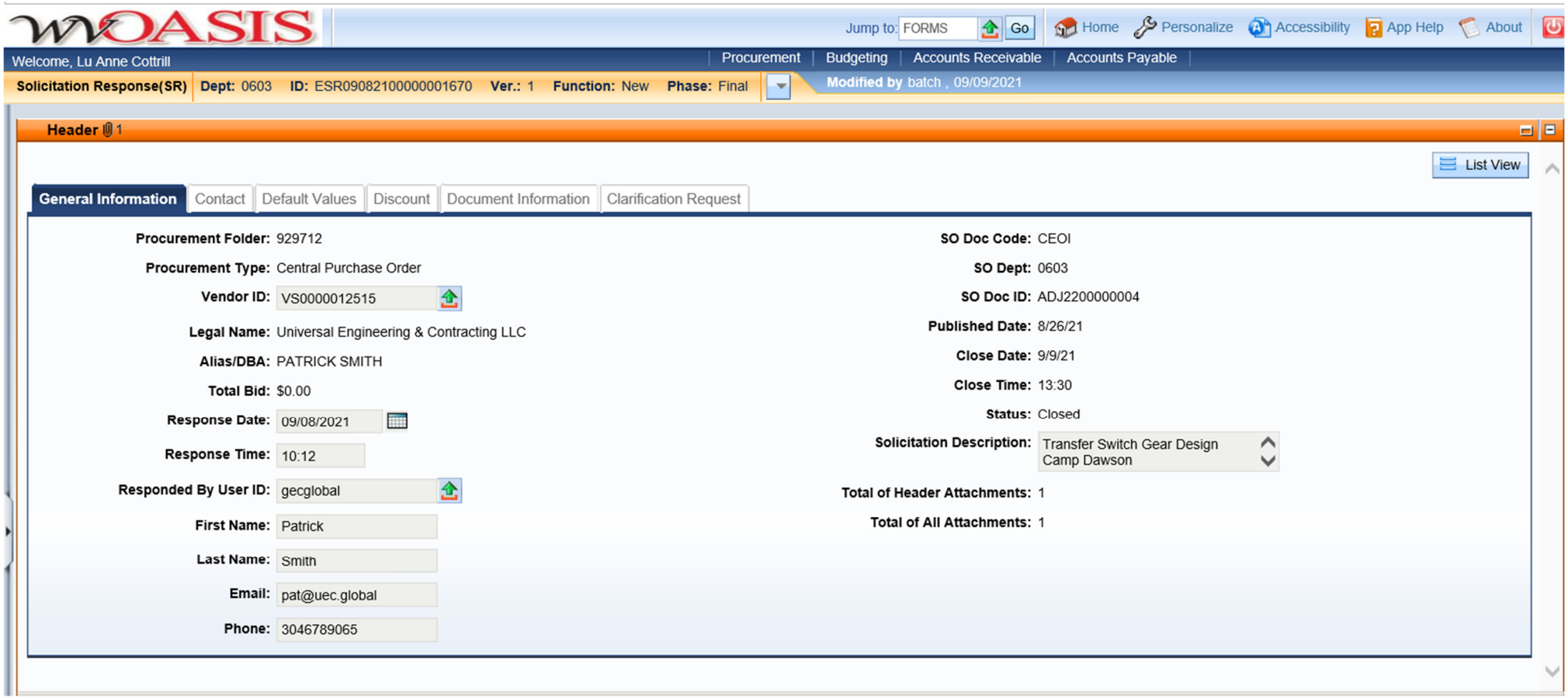
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Procurement
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Solicitation Response(SR) Dept: 0603 ID: ESR09082100000001670 Ver.: 1 Function: New Phase: Final
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Header 1
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Clarification Request
Procurement Folder: 929712
Procurement Type: Central Purchase Order
Vendor ID: VS0000012515
Legal Name: Universal Engineering & Contracting LLC
Alias/DBA: PATRICK SMITH
Total Bid: $0.00
Response Date: 09/08/2021
Response Time: 10:12
Responded By User ID: gecglobal
First Name: Patrick
Last Name: Smith
Email: pat@uec.global
Phone: 3046789065
SO Doc Code: CEOI
SO Dept: 0603
SO Doc ID: ADJ2200000004
Published Date: 8/26/21
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Status: Closed
Solicitation Description: Transfer Switch Gear Design Camp Dawson
Total of Header Attachments: 1
Total of All Attachments: 1

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Solicitation Response

Proc Folder:	929712
Solicitation Description:	Transfer Switch Gear Design Camp Dawson
Proc Type:	Central Purchase Order

Solicitation Closes	Solicitation Response	Version
2021-09-09 13:30	SR 0603 ESR09082100000001670	1

VENDOR

VS0000012515
Universal Engineering & Contracting LLC

Solicitation Number: CEOI 0603 ADJ2200000004

Total Bid: 0 **Response Date:** 2021-09-08 **Response Time:** 10:12:18

Comments:

FOR INFORMATION CONTACT THE BUYER
Tara Lyle
(304) 558-2544
tara.l.lyle@wv.gov

Vendor
Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	Transfer Switch Gear Design Camp Dawson				0.00

Comm Code	Manufacturer	Specification	Model #
81101508			

Commodity Line Comments: PLease see attached EOI

Extended Description:

Provide professional architectural and engineering design services per the attached documentation.

EXPRESSION OF INTEREST

For

CEOI ADJ2200000004

Camp Dawson Electrical Transfer Switch Gear Design

Submitted BY:

Universal Engineering & Contracting LLC

And DBA

Mountaineer Generator Service

400 Airport Road Suite 6C Elkins WV 26241

304-636-0011

Thanks for the opportunity to submit this EOI for your use and consideration. Universal Engineering & Contracting LLC (UEC) is well suited to design a replacement for the current Automatic Transfer Switch (ATS) at Camp Dawson. We have the unique set of skills and experiences to deliver the best suited design for this replacement.

UEC has designed, installed and serviced numerous ATS over the years. This combination of experience provides unique insight when designing a project like this. UEC's members have also been involved with numerous projects at Camp Dawson through the years. The knowledge of the base underground utilities and how they interconnect with the utility is invaluable in designing the new Camp Dawson Automatic Transfer Switch.

Some of the projects that members of UEC have Designed and or installed at Camp Dawson.

- Camp Dawson Underground Utilities design and installation Phase 1 & 2
- Camp Dawson Datacom conduit infrastructure design and installation.
- Camp Dawson Generator(s) and ATS installation.
- STF underground power installation.
- JITIC Generator(s) Installation
- Building 242 Generator Installation
- Camp Dawson Utilities River Crossing.
- Designed and installed Medium Voltage selector switch for at the generator site.

In Addition, UEC's Principal has a vast knowledge of the base and a long history with the WVNG.

Patrick Smith P.E.

- Retired from the WVARNG as a 210A (Prime Production Power Specialist) the rank of WO2
- Designed most of the above listed projects.
- Has been an Inspector/Designer/Contractor/ and service provider for numerous backup power projects. This combination of experience gives great insight into a sensible design from on site serviceability standpoint.
- Has delt in the past with Mon Power Representatives (Charles Lemley) with Mon Power with past Camp Dawson medium voltage transfer issues.

We will utilize L.R. Kimball for any disciplines to include:

- Geotechnical
- Civil
- Specifications generation

Proposed concepts and methods of approach.

- Ideally if permitted through State Purchasing: have the WVNG purchase the switchgear and prefab building direct. Current lead times for this type of switchgear is 30+ weeks. By the time the project is designed and then let to a contractor this timeframe will easily double.
- With the State Purchasing the gear direct, this leaves Civil, and installing the ATS to be Bid Out.
- While the Switchgear is in production the awarded contractor can perform the necessary geo and civil work (ie preparing the site and pouring the pad for the building.) This approach will give the NG the fastest replacement time for the existing troubled ATS.
- We have set many Medium Voltage ATS's in prefab buildings. Below is the switchgear and walk-in enclosure for the Richmond VAMC: This was factory assembled and then set in place in one day.
- The Original Camp Dawson Generator(s) and ATS location was picked to keep all elements out of the 100-year floodplain. (All of the distribution cabinets were placed to keep them out of the floodplain as well.) The new ATS can be placed in the same proximity, or all elements moved to another location if the WVNG prefers
- From previous work at Camp Dawson, we already have the preliminary switchgear design complete. Please see attached for Preliminary Sequence of operation and one line diagram.

Picture of Setting Fully Assembled Switchgear Building (with switchgear installed) at Richmond VAMC.

We offer the Following Camp National Guard References for your Review.

Mr. Robert Grimm: Project Manager Camp Dawson Engineering
SFC Arron Miller: Camp Dawson OPS building manager
Mr. Harvey Kerstetter, Camp Dawson STF Area Manager

Thanks for your consideration of this proposal, if you have any questions or would like any additional information, please let me know,

Patrick Smith P.E. *President*
Universal Engineering & Contracting LLC *and*
Mountaineer Generator Service
Cell: 304-678-9065 • **Work:** 304-636-0011• **Fax:** 304-621-6030
e-mail: Pat@UEC.Global

CERTIFICATE OF *Authorization*

STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

The West Virginia State Board of Registration for Professional Engineers having verified the person in responsible charge is registered in West Virginia as a professional engineer for the noted firm, hereby certifies

UNIVERSAL ENGINEERING & CONTRACTING LLC

C05608-00

Engineer in Responsible Charge: PATRICK A. SMITH - WV PE 014880

has complied with section §30-13-17 of the West Virginia Code governing the issuance of a Certificate of Authorization. The Board hereby notifies you of its certification with issuance of this Certification of Authorization for the period of:

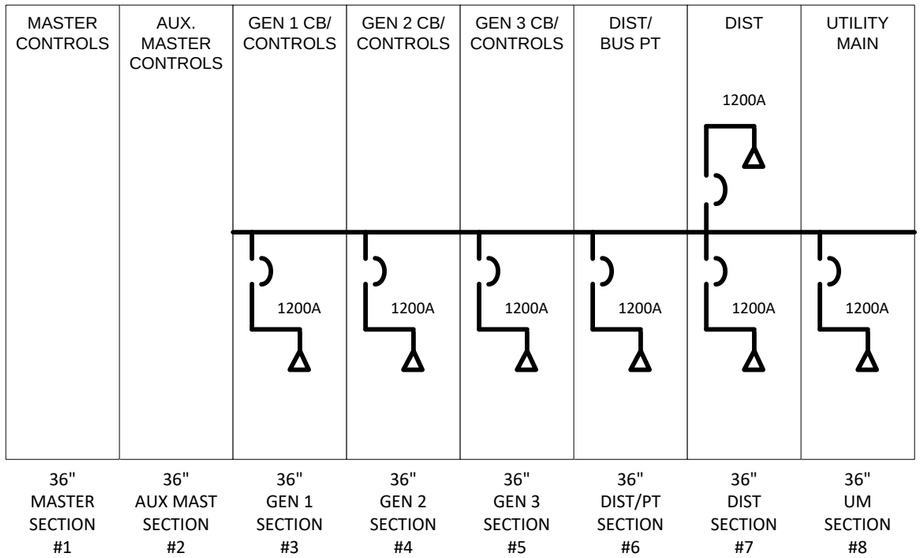
January 1, 2020 - December 31, 2021

providing for the practice of engineering services in the State of West Virginia.

IF YOU ARE REQUIRED TO REGISTER WITH THE SECRETARY OF STATE'S OFFICE, PLEASE SUBMIT THIS CERTIFICATE WITH YOUR APPLICATION.

IN TESTIMONY WHEREOF, THE WEST VIRGINIA STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS HAS ISSUED THIS COA UNDER ITS SEAL, AND SIGNED BY THE PRESIDENT OF SAID BOARD.

BOARD PRESIDENT



General System Notes:

11 GA FORMED STEEL FRAME CONSTRUCTION.

FINISH: ANSI 61 GRAY POLYESTER SEMI GLOSS ELECTROSTATIC POWDER.

DESIGNED FOR FRONT, SIDE AND REAR ACCESS.

ALL DOORS HAVE LOCKABLE HANDLES WITH COMMON KEYING, AND CAPTIVE SCREWS AS REQUIRED.

NEMA TYPE 1 INDOOR ENCLOSURE, FREE STANDING – FLOOR SUPPORTED.

System Specifications:

MAIN BUS SIZE: 1200A
UL LABEL: UL MV
SYSTEM VOLTAGE: 12470VAC

OVERALL DIMENSIONS:
288" W x 95" H x 91" D
36" W x 95" H x 30" D – MASTER & AUX. MASTER
SYSTEM AIC: 25KA

Project Name: Camp Dawson	
Drawing: Paralleling Switchgear	
Drawn By: PP	**Quote No: 200XXX**
ASCO Power Technologies®	**Date: 5/1/2020**

Appendix A

SEQUENCE OF OPERATION

Table of Contents

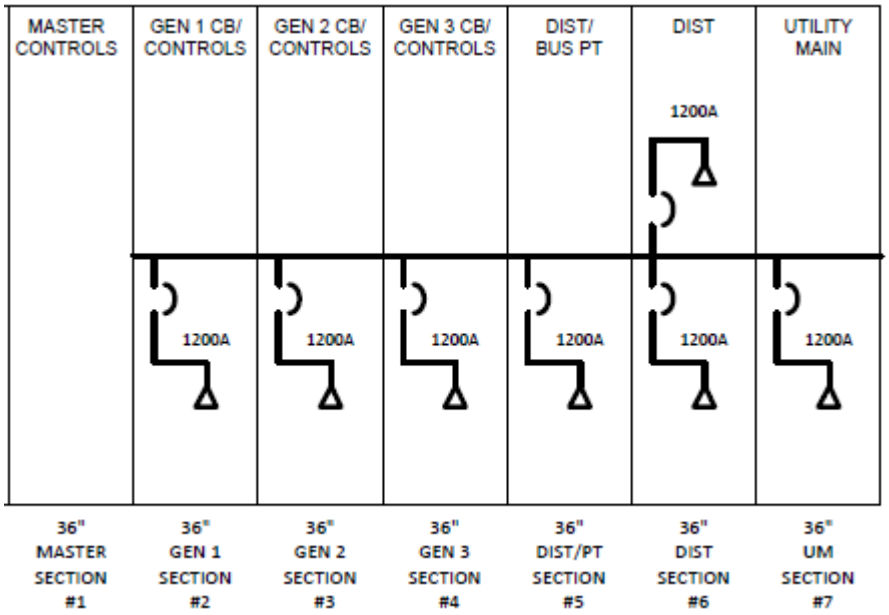
1 General

This system is comprised of (2) incoming main utilities and (4) engine generators sized at 2000kW, controlled by redundant Rx3i PLC.

1. GPS-1 – Incoming Main Utility & Emergency Paralleling Switchgear

The GPS-1 Switchgear has (2) utility incoming sources (Utility East and Utility West) and is segregated into (2) buses: Bus A includes the east utility main and normal distribution and Bus B includes the west utility, normal distribution and generator paralleling sources. The GPS-1 switchgear allows either open or closed transition softload transfer operations with either the East Utility Source or West Utility Source.

1.1 GPS-1 System One-Line



Normal Breaker Status is as follows:

52U – Utility Main Circuit Breaker – Closed
52A1-52A3 –Distribution Circuit Breakers – Closed
52G1 – Generator 1 Paralleling Circuit Breaker – Open
52G2 – Generator 2 Paralleling Circuit Breaker – Open
52G3 – Generator 3 Paralleling Circuit Breaker – Open

1.2 Controls

System control is integrated within the switchgear lineup and distributed in several locations and across multiple controllers.

Master PLC's: Master PLC's are Modicon M580 PLC's. There are a total of two (2) master PLC's (PLC-1, PLC-2), each located within one of the Master Control Section. Each PLC is capable of controlling the entire system. The Master PLC's include two separate Ethernet Interfaces each. One is used for PLC redundancy and IO communication and the other is used to interface with the OIT.

System IO: System IO is distributed across several different locations and this distributed IO can be controlled by any one of the (2) Master PLC's. Distributed IO will only listen to one PLC at a time. Distributed IO is located in throughout the switchgear. Dual (redundant) IO is provided for each IO point. Redundant LANs are provided for PLC and I/O communication.

Generator PLC's: Generator PLC's are Modicon M340. One will be provided for each generator in each generator section. Generator control is integrated with the switchgear. There are four (4) generators and (4) generator PLC's in the switchgear lineup. Generator IO is integral to the generator PLC and is controlled by that PLC only. The generator PLC includes an Ethernet interface to communicate to the PowerQuest screen in the master section for operator interface. A hardwired backup circuit is provided to get and keep the generator online when required even if the generator PLC has failed.

Generator Synchronizer and Load Controllers: These controllers will be Woodward Digital Synchronizer and Load Share Controllers (model DSLC2) with redundant Ethernet communication LANs for load control and monitoring.

Master Synchronizer: Master Synchronizers (model MSLC2) are provided in this system across source interconnect points. There are redundant Ethernet LAN's for communicating between the MSLC and the DSLCs.

PowerQuest Screen (OIT): There will be one Operator Interface Terminal (OIT) in the Master Section. The OIT provides SCADA/HMI functionality and serves as the operator interface with the System controller for adjustable settings. These settings will be password protected. A system one-line will be provided showing all devices controlled by the PLCs.

1.3 Master Control Section (GPS-1)

This section contains the two redundant Master PLCs and a 24" Operator Interface Panel (OIP). It also contains the Master Control Stations (hard-wired). The OIT will provide visual information and control for both the GPS-1 switchgear lineup.

1.4 Control Power

125VDC control power will be provided by a new 125VDC Station Battery.

1.5 Control Switches

1.5.1 Plant Selector Switch

One plant selector switch (PSS) is mounted on the Master Control Section. This switch selects the connections for the Synchroscope and sync check relay and is used to verify synchronism prior to a manual (or manually initiated) paralleling operation.

Plant Selector Switch

Position	Description
Off	Synch-scope and manual parallel circuit are disabled
Generator 1	Synch-scope and manual parallel circuit active for Generator 1
Generator 2	Synch-scope and manual parallel circuit active for Generator 2
Generator 3	Synch-scope and manual parallel circuit active for Generator 3

1.5.2 Master Control Station

The master control station is located on the master control door.

Function		Description	Comment
Master Control	**Auto**	All functions performed automatically	2-position key switch; key withdrawn in Auto only
	Manual	All functions performed manually. Flashing red light will indicate "*Controls Not In Auto".*	
Priority Load Shed Bypass/Reset (1 provided for each priority block)		Used to add or shed load that is in addition to the load blocks that can currently be supported by the system.	If only 1 gen was connected to the bus, pressing Priority 2 button will allow the priority 2 load block to be added to the bus.
Bus Alarm Reset		Resets all visual alarms no longer active for the System PLC	Non-illuminated pushbutton
Alarm Silence		Silences audible alarm indication	Illuminated pushbutton (Red); lit when active
Manual Parallel		Allows Manual connection of a Generator to a Dead Bus or when in Island Mode	Lighted pushbutton (Amber); lit when enabled
Transition Mode	**Closed**	All transfer operations are performed via closed transition softload transfer.	2-position key switch
	Open	All transfer operations are performed via open transition transfer.	
Building Load Test	On	A building load test will be initiated connecting bus to the generator source.	2-position key switch
	Off	The system will exit the building load test or remain in current state (if not in building load test).	

1.5.3 Generator Controls

The Generator Control Station is located on the Generator door.

Function		Description	Comment
Engine Control (5-position Control Switch)	Lockout / Reset	Lockout generator and resets shutdowns	Hard Shutdown (breaker opens and engine shuts down without cooldown)
	Off / Cooldown	Generator offline and cooldown cycle	Soft shutdown
	Automatic	Allows normal operation	Normally Left in Auto
	Test Offline	Starts and synchronizes the generator to the bus	Paralleling breaker remains open
	Test Online	Starts and synchronizes the generator to the bus	Paralleling breaker will close if correct conditions are met
Synchronizing Mode Switch (4-position Switch)	Permissive	No active synchronization	Allows CB closure if in phase window
	Check	Active Sync only	Will not close CB
	Off	No control	Will not close CB. Used for Manual Parallel Operation
	Run	Active Sync and CB closure	Normally left in Auto
Emergency Stop		Hard Shutdown and Lockout	Red Mushroom push/pull button
Alarm Reset		Resets flashing visual alarms	Non-illuminated pushbutton
Voltage Control	Lower	Lowers generator voltage	3-position switch; spring return to center; enabled only in Manual
	Raise	Raises generator voltage	
Frequency Control	Lower	Lowers the generator frequency	3-position switch; spring return to center; enabled only in Manual
	Raise	Raises the generator frequency	

1.5.4 Circuit Breaker Control Switches

The trip function on Circuit Breaker Control Switches is available at all times. Anytime a breaker is manually tripped, a device 86 lockout relay will be activated to prevent the PLC from re-closing the manually opened breaker. The device 86 status will be wired into the PLC so that the OIT can display the condition.

The manual close function of PLC controlled breakers is only enabled when the system is in Manual Mode or all PLC control has failed. Circuit breakers that are part of a transfer pair or tie breaker scheme will have interlocks in place to prevent the paralleling of sources by control switches.

2 Normal Mode

Whenever the Master local control switch is in the automatic position and each individual engine generator control switch is placed in their automatic position, the engine generator system is on standby in readiness for automatic starting and synchronization in the event of a power failure signal.

3 Emergency Mode

Any time a Utility outage is sensed and/or Generators are called to start in anticipation of feeding building load, the system will annunciate this condition as Emergency mode. Utility outage can be sensed at the Line side of 52U via the protective relay associated with that breaker.

- All generator(s) automatically start and come up to speed.
- The first generator set to achieve 90% of nominal voltage and a frequency above 59Hz shall be connected to the bus.

Note: Electronic interlocks permit the connection of only one engine generator to the dead generator bus in the event of simultaneous generator relay operation.

- After the bus is energized by the first generator, the generator synchronizers will automatically adjust the frequency of the next on-coming generator to synchronize with the bus.
- When synchronism is achieved, the on-coming generator is paralleled to the bus.
- The generators connected to the bus will all share load and VARs proportionally.

Possible Failure Modes:

Fail To Sync: the condition will be annunciated. The generator will be allowed to continue running. Synchronization attempts will continue as long as the generator is running.

52G# Fail To Close: the condition will be annunciated the affected generator will be shutdown. The condition may be reset at any time via the lockout/reset position of the engine control switch.

DSLC failure: If the DSLC fails, the condition will be annunciated and the affected generator will be shutdown. The remaining DSLCs will recognize that the unit is offline and reconfigure the network so that the remaining units can come online and share load.

Load Sharing network failure (LAN A or LAN B): Load sharing is done via two Ethernet LANs. If a single LAN fails, the condition will be annunciated but the system will maintain full functionality via the redundant LAN.

3.1 Block Load Control

Loads are grouped into Priority blocks, one for each generator. Each load has an adjustable priority setting, estimated KW value and step time delay associated with it. The aggregate sum of kW within the block should be less than the rating of the smallest generator.

- When the first generator is connected to the bus, all Priority 1 loads will begin their step time delay.
- When the load step time delay is complete (or if the time delay is set to zero), the feeder breaker associated with the load will immediately receive a close signal connecting any downstream devices to emergency power.
- As soon as the second generator is connected to the bus, all of the Priority 2 loads will begin their step time delay.
- When the load step time delay is complete (or if the time delay is set to zero), the feeder breaker associated with the load will immediately receive a close signal connecting any downstream devices to emergency power.
- As soon as the third generator is connected to the bus, all of the Priority 3 loads will begin their step time delay.
- When the load step time delay is complete (or if the time delay is set to zero), the feeder breaker associated with the load will immediately receive a close signal connecting any downstream devices to emergency power.

Possible Failure Modes:

Generator Failure: If a generator fails while operating in the automatic mode, it is disconnected from the Bus and shutdown. Visual alarms will be activated to indicate the condition. System loads will not shed unless a bus overload or a bus under frequency occurs. This feature is referred to as “Load-Latch”.

Bus Overload: If the online load exceeds 105% of rated generator capacity, the condition will be annunciated and unsupported loads (loads in priority blocks greater than the number of generators online) will be step shed in reverse priority at one second intervals. No loads in priority blocks equal to or less than the number of generators online will be shed. (Ex. If you have two generators online, load blocks 1 and 2 will stay online, priority 3 and above will be shed). The Bus Overload light will light to indicate that the bus is overloaded and automatically reset as the overload is corrected. When the online load no longer exceeds 105% of the generator capacity, step shedding will cease, and the system will continue to power the loads that are left online.

Bus Under frequency: When a bus under frequency is detected a time delay (hard coded at 3 seconds) will start timing out. After the time delay expires, blocks of load will be shed automatically such that the remaining load blocks shall be one less than the number of generators remaining on the bus. (Ex. If you have two generators online, only load block 1 will stay online, priority 2 and above will be shed). Bus under frequency is a latched condition that must be manually reset and can only be reset after the condition has been alleviated. Note: priority 1 loads will never be automatically shed.

Severe Bus Under frequency: When a bus under frequency is detected a second time delay (hard coded at 5 seconds) will start timing out. After the time delay expires, blocks of load will be shed automatically such that only the Priority 1 load block will be remaining. Severe Bus under frequency is a latched condition that must be manually reset and can only be reset after the condition has been alleviated. There is only one status tile provided for Bus Under frequency annunciation, but the OIT will display if a Severe Bus Under frequency shed condition has been activated. Note: priority 1 loads will never be automatically shed.

Load Shed annunciation: Indicating lights will annunciate the status of each Priority load block, indicating if any loads in that block are shed or if the load block is manually bypassed.

3.2 Automatic Mode (with Auto or Manually Initiated return)

Switch Position: (note - switches not shown may be placed in any position)

Control Station	Switch	Position
Master	Master Control	Auto
	Return To Normal	Auto/Manually Initiated
Generator	Generator Control	Auto
	Sync Mode	Run
	E Stop	Out (Not Active)

With the “Return to Normal Response” switch in the “Manually Initiated” position, all loss of Utility sequences will remain unchanged.

When Utility is restored, Manually Initiated re-transfers will not wait for a re-transfer time delay. As soon as the Utility is available, the illuminated “Transfer Initiate” push button will be lit. Re-transfer will not occur until the operator pushes the “Transfer Initiate” push button. When the operator pushes the button, sequence will commence the same as sequences described below for automatic return. During retransfer, the “transfer initiate” button will flash while the sequence is active.

With the switches in the above position, the system is in Automatic mode and will operate per the following sequences (Note: these sequences start from Normal Mode split bus configuration):

3.2.1 Loss of Utility

Note: loss of Utility needs to be sensed at the line side of breaker 52U.

Note: a commit feature will continue transfer to completion even if the Utility is restored during the transfer.

- Upon loss of Utility Service, the Master PLC will initiate a “Utility Outage” time delay (adjustable 0-60 seconds; factory default 1 sec).
- 52U will be opened and all generators will be started.
- All distribution breakers will be opened.
- The first generator to achieve 90% of nominal voltage and frequency will be connected to the bus. Interlocks will inhibit simultaneous connection of generators to a dead bus.
- Priority 1 distribution breakers will be allowed to close per the individual step timers.
- As each generator synchronizes to the bus, it will be connected and the associated priority block will be added per its subpriority and step timer.

3.2.1.1 Possible Failure Scenarios

52U Fail To Open: the condition will be annunciated. Bus will remain de-energized (until utility U is returned). The condition cannot be reset until 52U is open or the Utility has returned as sensed at the line side of 52U.

Feeder Fail To Open: the condition will be annunciated and attempts to open the breaker will be stopped. The transfer sequence will be allowed to continue. The condition may be reset at any time.

Feeder Fail To Close: the condition will be annunciated and attempts to close the breaker will be stopped. The transfer sequence will be allowed to continue. The condition may be reset at any time.

3.2.2 Return from Loss of Utility

When Utility is restored, as sensed at the line side of breaker 52U, a “Utility Restore” time delay (adjustable 0-60 minutes; factory default 30 min) will initiate. Upon expiration of the time delay and depending on the position of the Transition Mode switch, the following sequences may occur:

3.2.2.1 Soft Load (Closed) Transition Mode

- The generators will be synchronized with Utility across 52U.
- While the two sources are in sync, 52U will be closed and the generator(s) will be unloaded until the load sensed across the 52Gx breakers is at the unload trip level.
- The 52Gx breakers will be opened.
- The generators will be allowed to run for cool down before being shutdown.

3.2.2.1.1 Possible Failure Scenarios

Load Shed Active: Switchgear will remain connected to generator and shed feeders will remain open until the retransfer to Utility is complete. The operator may bypass the retransfer time delay at any time by hitting the “Bypass Retransfer Time Delay” button on the OIT.

Fail To Sync: the condition will be annunciated. Synchronization attempts will continue.

52U Fail To Close: the condition will be annunciated. Utility will be treated as unavailable while the condition is active. System will stay on generator until the condition is reset or the operator has manually initiated a transfer to Utility. The condition may be reset at any time.

52Gx Fail To Open: the condition will be annunciated. The connected utility source will be opened and the system will remain connected to the generator source. The condition can be reset at any time.

3.2.2.2 Open Transition Mode

- 52Gx breakers will be opened.
- All distribution breakers will be opened.
- After an Open transition TD (adjustable 0-30 sec; fact set at 5 sec), 52U will be closed.
- Distribution breakers will be closed per their priority and step timer.
- The generators will be allowed to run through cooldown and shutdown.

3.2.2.2.1 Possible Failure Scenarios

52Gx Fail To Open: the condition will be annunciated. The system will reconnect the generator sources and will remain connected to the generator source. The condition can be reset at any time.

Feeder Fail To Open: the condition will be annunciated and attempts to open the breaker will be stopped. The transfer sequence will be allowed to continue. The condition may be reset at any time.

52U Fail To Close: the condition will be annunciated. Utility will be treated as unavailable while the condition is active. System will retransfer to the alternate utility source (if available) and stay on the source until the condition is reset. The condition may be reset at any time.

Feeder Fail To Close: the condition will be annunciated and attempts to close the breaker will be stopped. The transfer sequence will be allowed to continue. The condition may be reset at any time.

4 Load Test Modes

4.1 Normal Operation

Switch Position: (note - switches not shown may be placed in any position)

Control Station	Switch	Position
Master	Master Control	Auto or Manual
	Building Load Test	Off
	Transition Mode	Closed or Open
Generator	Generator Control	Auto
	Synchronizing Mode	Run

- When the system control switches are in the above positions, the system will stay on its last selected source.

4.2 Building Load Test Initiation

Switch Position: (note - switches not shown may be placed in any position)

Control Station	Switch	Position
Master	Master Control	Auto
	Building Load Test	**On**
	Transition Mode	Closed or Open
Generator	Generator Control	Auto
	Synchronizing Mode	Run

- With the system control switches in the above positions, the “Transfer Initiate” button will be lit.
- When the operator pushes the “Transfer Initiate” button, it will start flashing, indicating that a transfer is in progress.
- The generators will be started.

4.2.1 Soft Load (Closed) Transition Mode

- The generators will be synchronized to the Utility source.
- Upon achieving synchronization, each generator will be connected to the bus.
- Utility will be unloaded across the 52U breaker until the load sensed across 52U reached the unload setpoint (200kW).
- 52U will be opened.

- Once the building is connected to the generator source, the “Transfer Initiate” button light will go out.

4.2.1.1 Possible Failure Scenarios

52Gx Fail To Close: The condition will be annunciated. The sequence will be aborted. The condition can be reset at any time.

52U Fail To Open: The condition will be annunciated. The sequence will be aborted. The condition can be reset at any time.

Fail to Synchronize To Utility: The condition will be annunciated and the system will continue in attempts to synchronize until the sequence is aborted by the operator.

4.2.2 Open Transition Mode

- 52U will be opened.
- 52A1-52A3 will be opened.
- After an Open transition TD (adjustable 0-30 sec; fact set at 5 sec), the generators will be allowed to connect to the bus.
- The distribution breakers will be allowed to close per their priority and step timer.
- Once the building is connected to the generator source, the “Transfer Initiate” button light will go out.

4.2.2.1 Possible Failure Scenarios

52U Fail To Open: The condition will be annunciated. The sequence will be aborted. The condition can be reset at any time.
52Gx Fail To Close: The condition will be annunciated. The sequence will be aborted and the system will be re-transferred to the utility source by closing the 52UW breaker. The condition can be reset at any time.

4.3 Building Load Test Exit

Switch Position: (note - switches not shown may be placed in any position)

Control Station	Switch	Position
Master	Master Control	Auto
	Building Load Test	**Off**
	Transition Mode	Closed or Open
Generator	Generator Control	Auto
	Synchronizing Mode	Run

- With the system control switches in the above positions, the “Transfer Initiate” button will be lit.
- When the operator pushes the “Transfer Initiate” button, it will start flashing, indicating that a transfer is in progress.

4.3.1 Soft Load (Closed) Transition Mode

- The generators will be synchronized with Utility across 52U.
- While the two sources are in sync, 52U will be closed and the generator(s) will be unloaded until the load sensed across the 52Gx breakers is at the unload trip level.
- The 52Gx breakers will be opened, removing the generators from the bus.

- The generators will be allowed to run for cool down before being shutdown.

4.3.1.1 Possible Failure Scenarios

Load Shed Active: Switchgear will remain connected to generator and shed feeders will remain open until the retransfer to Utility is complete. The operator may bypass the retransfer time delay at any time by hitting the “Bypass Retransfer Time Delay” button on the OIT.

Fail To Sync: the condition will be annunciated. Synchronization attempts will continue.

52U Fail To Close: the condition will be annunciated. Utility will be treated as unavailable while the condition is active. System will stay on generator until the condition is reset or the operator has manually initiated a transfer to Utility. The condition may be reset at any time.

Extended Parallel: while the two sources are in parallel, an extended parallel timer will count down. If the timer expires, 52U will be opened regardless of the load level sensed at 52U. The condition will be annunciated.

52Gx Fail To Open: the condition will be annunciated. The connected utility source will be opened and the system will remain connected to the generator source. The condition can be reset at any time.

4.3.2 Open Transition Mode

- 52Gx breakers will be opened.
- 52A1-52A3 breakers will be opened
- After an Open transition TD (adjustable 0-30 sec; fact set at 5 sec), 52U will be closed.
- 52A1-52A3 breakers will be closed per their priority and step timer.
- The generators will be allowed to run through cooldown and shutdown.

4.3.2.1 Possible Failure Scenarios

52Gx Fail To Open: the condition will be annunciated. The system will reconnect the generator sources and will remain connected to the generator source. The condition can be reset at any time.

Feeder Fail To Open: the condition will be annunciated and attempts to open the breaker will be stopped. The transfer sequence will be allowed to continue. The condition may be reset at any time.

52U Fail To Close: the condition will be annunciated. Utility will be treated as unavailable while the condition is active. System will retransfer to the generator source and stay on the source until the condition is reset. The condition may be reset at any time.

Feeder Fail To Close: the condition will be annunciated and attempts to close the breaker will be stopped. The transfer sequence will be allowed to continue. The condition may be reset at any time.

5 Manual Modes

Switch Position: (note - switches not shown may be placed in any position)

Control Station	Switch	Position
Master	Master Control	**Manual**

When the system is put in “Manual”, audible and visual alarms will indicate the condition. Generators will not start automatically in Manual Mode, however if generators are already online when manual mode is selected, they will stay online. If there is any Utility power failure, no automatic control will occur from the controls. The system should be put back into “Auto” mode if possible. If that is not possible the following operations are available:

5.1 Manual Breaker Operation (Source Circuit Breakers)

The Circuit Breakers can be closed via the circuit breaker control switch when the following is true:

- Utility Main Circuit Breaker 52U
  - 52Gx are open.

5.2 Manual Breaker Operation (Distribution Circuit Breakers)

- All feeder breakers can be operated via the Circuit Breaker Control Switch located on the cubicle door. **No interlocks are required on the distribution circuit breakers in the GPS-1 switchgear**.

5.3 Generator Control Station Operation

The Generator Control Station is still operational in Manual Mode and all Engine Control Switch Functions are still available, including the following:

- Test Offline – Starts Generator but does not sync or close paralleling breaker
- Test Online – Starts generator, synchronizes it to the bus if necessary, and connects it to the emergency bus via the paralleling breaker if the bus is not connected to a utility source.

5.4 Manual Parallel

The system includes a Manual Paralleling feature. This mode can be used when the automatic means of synchronizing a Generator to an energized Bus is not functioning properly or when a manually initiated transfer between two sources is desired. Optimum conditions for manual paralleling would be for the Generator to have a slightly faster frequency than the Bus (approximately 60.02 Hz for a 60.00 Hz bus).

A Generator Speed Control Switch is provided to Manually Raise and Lower the Speed of the Generator and a Generator Voltage Switch is provided to provided to Manually Raise and Lower the Generator Voltage.

The System control switch must be placed in Manual for Manual paralleling operations.

The Generator that will be paralleled to the Bus should have its Synchronizing Mode Switch turned to **OFF**. This disables the Automatic Raise/Lower speed signals that are sent to the Generator if the Synchronizer was active. The Generator should be selected on the **Parallel Selector Switch** on the Master Control section door. When the Generator is out of phase with the Bus and /or the Voltage

Differential is over 10%the ***Manual Parallel light*** will be lit and Manual Synchronization is not permitted. When the Generator voltage phase differential is less than +/-10^{o} electrical degrees and the Voltage Differential is less than 10% the Synch-scope indicating voltage phase within the window; the ***Manual Parallel light*** will not be illuminated indicating Manual Paralleling is permitted.

If the Generator frequency is greater than the Bus, the Synch-scope indicator will rotate in the *Fast* direction. If the Generator frequency is less than the Bus, the Synch-scope indicator will rotate in the *slow* direction. When the Synch-scope is at approx. 12 o'clock and the ***Manual Parallel*** light in not illuminated, the *Sync Check* device (25C) operates and the operator may operate the applicable CB Breaker Control Switch breaker to close the applicable CB.

The operator may them use the Generator Speed Control Switch to Raise or Lower the Load on the Generator and then open the applicable CB by operating the applicable CB Control Switch.

6 Features

6.1 Block Load Control

Each load has an adjustable priority setting, estimated KW value and step time delay associated with it. As each block of load is allowed to transfer to emergency power, the individual loads will begin their step time delay. As the time delay for each load completes, the load will receive a permissive signal to transfer to emergency power. If no delay is desired, the individual step times can be set to zero seconds, and the loads will transfer immediately when the load block is permitted to transfer to emergency.

Note: Any automatic transfer switch without the 30B accessory (Load Shed) will automatically transfer to emergency on its own regardless of the permissive signal. Typically, critical priority 1 loads will not have a 30B accessory.

If a generator fails while operating in the automatic mode, it is disconnected from the bus and shutdown. Audible and visual alarms will be activated to indicate the condition. System loads will not shed unless a bus overload or a bus under frequency occurs. This feature is referred to as "Load-Latch".

A push-button permits override of the load-shed circuits for supervised operation (one for each priority except priority 1). Loads that have been block shed can be manually re-added using the priority-# Load Shed Bypass/Reset push-button located on the Master control section. By pressing the Load Shed Bypass/Reset push-button, the system will transfer the selected load block to the emergency bus. By pressing the Load Shed Bypass/Reset push-button a second time, the ENTIRE selected load block will shed. Indicating lights will annunciate the status of each Priority load block, indicating if it is shed or manually bypassed. If the operator inadvertently bypasses the load shed and overloads the Generator(s) resulting in a bus under-frequency, all manually bypassed loads will be automatically shed along with blocks of load such that the remaining load blocks shall be one less than the number of generators remaining on the bus. The "Bus Under Frequency" annunciator light will indicate this condition.

If the online load exceeds 105% of rated generator capacity, unsupported loads (loads in priority blocks greater than the number of generators online) will be step shed in reverse priority at one second intervals. No loads in priority blocks equal to or less than the number of generators online will be shed. (Ex. If you have two generators online, load blocks 1 and 2 will stay online, priority 3 and above will be shed). The Bus Overload light will light to indicate that the bus is overloaded automatically reset as the overload is corrected. When the online load no longer exceeds 105% of the generator capacity, step shedding will cease, and the system will continue to power the loads

that are left online. Indicating lights will annunciate the status of each Priority load block, indicating if any loads in that block are shed or if the load block is manually bypassed. If the operator bypasses the load shed to bring those shed loads back online, and the online load exceeds 105% of capacity again, the system will again step shed loads in reverse priority until the load no longer exceeds 105% of capacity. This is done in an attempt to prevent an under frequency situation, thereby preventing the entire load block from being shed.

6.2 Load Bus Optimization

Each load should be programmed with a load priority value (field adjustable, accessible via the OIT on the master section door). A load's priority value is a 3-digit number. The most significant digit refers to the load's block priority value (i.e. 201 => priority 2 load block, whereas 118 => priority 1 load block). The two lower significant digits refer to the load's sub-priority value, or load step priority (i.e. 201 => priority 2 block, step 1; and 118 => priority 1 block, step 18). Valid priority values are 1 – 12 while valid sub-priority values are 1 - 99. Therefore, valid three digit priority values are 101 - 1299. Note: 3 digit priority values of 200, 300 and 400, etc. are not valid priority numbers. Because of the dynamic nature of the adjustable load priorities, all loads, even priority 1 need to have sub-priority step values.

Should a Priority Block fail to be added to the bus while operating in the Emergency Mode, Load Bus Optimization is provided to re-add shed loads one at a time based on predetermined kW loading values up 95% (adjustable via OIT) of the capacity of the on-line power. This percentage value is referred to as the Bus Optimization KW de-rating value.

With the Bus Optimization switch in the "on" position during emergency mode and with loads shed (loads requiring power but are not connected to the emergency bus), after a stabilization time delay (Bus Opt stable delay) the optimization feature is activated and a *Bus Optimize Active* light illuminates. The *Bus Optimize Active* light flashes through the duration of the stabilization time delay (default 30 seconds, adjustable via OIT). At this time, the Bus Optimization loading control will determine if there is enough room to add the next load by checking the pre-set Load Value (field adjustable, accessible via the OIT) assigned to the first sub-priority within the highest priority block that is shed and compare it to the excess generator bus capacity (also known as Headroom).

If it is determined that the load can be added without exceeding the Bus Optimization KW de-rating value, the load is signaled to add. The real time kW output of the generator bus is constantly measured and the next sub-priority load is evaluated. Loads are evaluated at a preset time interval defined via the OIT (Bus Opt Step Time). When the bus has been loaded to a level such that the next load would exceed the de-rating value, the *Next Load Exceeds Headroom* light will activate and load adding will pause. The system will continuously monitor the generator load and evaluate if the next load step can fit on the bus. If building load decreases and the next load can fit (for the duration of the step time delay), the system will add it and continue the evaluation process until as many loads as possible are added to the bus.

If the load has already been added, there is no reason to compare it to see if it will fit, and the program will skip to the next available load.

If at any time, the online load exceeds 105% of available rated capacity, the system will remove the last load that was added. If the online load does not decrease to less than 105% of rated capacity, loads will be shed one at a time, every second in reverse order until the overload is corrected **or until only Priority one loads are left online**. Priority one loads will not be shed. The Bus Overload light will light to indicate that the bus is overloaded and will be automatically reset once the overload is corrected. In this event, the system will begin a 30 second overload stabilization delay time (fixed) before evaluating additional load to be added to the bus.

If a generator fails, it will be removed from the bus. If the remaining loads online exceed 105% of the remaining online generator capacity, the loads will step shed as described in the previous paragraph. If the load does not exceed the online capacity, no loads will shed.

Severe Bus Overload
If the number of generators online is less than the number of generators in the system (because of load demand, generator failure, or shutdown of a generator) and the connected load exceeds 120% of online capacity, **all non priority one loads will immediately shed** in an attempt to avoid an under frequency event. A light labeled Bus Overload will light indicating that the bus is severely overloaded. The system will NOT attempt to re-add loads until the Bus Overload light is acknowledged by pressing the Alarm Reset pushbutton on the master section door or all generators come online. Manual load shed bypass can still be used to add load blocks at this time.

In the event of a bus Under-frequency, all non priority one will be shed. The “Bus Under Frequency” annunciator light will indicate this condition.

No loads can be manually added while a bus under frequency alarm indication is active. The operator must acknowledge the alarm by pressing the Alarm Reset pushbutton (provided bus under frequency is still not active). After the operator acknowledges the alarm, the bus optimization will start adding loads after a bus optimization start time delay and in the same manner as described previously for bus optimization in the preceding paragraphs.

Once all loads in a priority load block have been added to the bus, the LOAD SHED ACTIVE light will turn off.

6.3 Generator Load Demand Control

The Load Demand logic controls the number of generating sets to remove excess generator capacity and add additional capacity when needed, thus keeping the optimum number of generators online at all times. Generator load demand saves fuel and wear by running less generators at a more efficient load level.

Entering Load Demand Mode
After all generators sets have been paralleled to the bus and all loads connected that require power, a stabilization time delay (0-300 seconds) factory sets at 30 seconds will be initiated while a Load Demand Mode light flashes. At the expiration of the time delay period, the system will operate in load demand mode at which time the mode light remains illuminated.

Removal of Generator Sets from the Bus
The number of generators a system requires at any time is defined as N. Load demand seeks to remove the lowest priority generators (priority value set at OIT) that are in excess of N. When the system is operating with more generators online than the system needs and the system load falls below the drop out load value (default setting of 80% KW rating of N generators) a 20 second time delay (field adjustable from 0 - 300 seconds) is initiated and a “Gen Stop TD Active” light start flashing. If the load stays below the dropout value for the duration of the time delay, the generator(s) with the lowest priority that are excess capacity will be taken offline. The engine(s) will run for their cool down period, then shutdown.

Determining dropout value:
(Number of generators in system – 1) x (Drop out %)

If while operating in the load demand mode, an engine-generator set malfunction occurs and the generator goes offline, Load Demand mode will momentarily reset and all remaining generators will be brought online.

If the online load exceeds 105%, but does not exceed 120%, loads in blocks not equal to the number of generators online will be step shed based on priority, one every second, until the system load falls to not more than 105%.

If the online load exceeds 120% of capacity, signals will be given to shed load such that the connected priority blocks of load are reduced to equal the number of engine generator sets on line (only when load demand mode is active). When the next set is paralleled to the bus, the shed load will be reconnected and all controls automatically reset. If the next generator does not come online, the system will not automatically reset. The Bus Overload light will blink to indicate that the bus was overloaded and will stay on solid (not blinking) if the bus remains overloaded. Loads will not be added to the bus while the Bus Overload light is active (blinking or solid). Once the operator acknowledges the Bus Overload light and presses the Alarm Reset push-button, then the loads will be re-added as capacity allows (In Load Bus Optimization mode).

Addition of Generator Sets from the Bus

If the bus KW (system load), is equal to or greater than the generator load demand pickup value for the duration of the load demand start td (default 5 seconds), the controls will initiate the starting and paralleling of the next set in sequence. If, during the time delay period, the online load exceeds 120% of the online generator capacity (signifying severe bus overload), the time delay will be bypassed and the next set in sequence will be immediately started and paralleled. Any loads blocks not equal to the number of generators online will be shed. If the online load exceeds 105%, but does not exceed 120%, loads in blocks not equal to the number of generators online will be step shed based on priority, one every second, until the system load falls to not more than 105%.

7 Test Facilities

7.1 Generator No Load Test

A system test switch is mounted inside the master control cubicle to limit access to authorized persons only. Operation of this switch will start and parallel all generators. However, unless a normal source outage occurs during this mode of operation, the transfer switches will not transfer its load to the emergency bus. To terminate this test, the system test switch is reset to initiate a normal system shutdown sequence.

7.2 Single Engine Test

Each engine can be started for test purposes by placing its generator control switch to the off-line position. In this mode, the generator circuit breaker will remain open. Should a normal source outage occur during this mode of operation, the breaker will close and the remaining units will be started. Upon restoration of normal power, the system will revert to single engine test mode until the switch is returned to the AUTOMATIC position. For on-line test, placing of the generator control switch to the on-line position will present a similar operation except that the generator breaker will close when the generator achieves nominal voltage and frequency.

8 Failure Sequences

Note: detailed failure sequences pertaining to specific system operations are provided throughout this document. Below are general failures noted for overall system operation.

Fail To Close (FTC): for all controlled breaker closures, 4 close attempts (2 seconds on, 2 seconds off) will be issued before the breaker fail to close condition is annunciated.

Fail To Open (FTO): for all controlled breaker trips, 1 trip attempt of adjustable duration will be issued and the breaker fail to open condition will be annunciated if the breaker is not opened before the time delay expires.

8.1 Utility Main Breaker Fail to Close

In the event a Utility Main breaker Fail to Close, all sequences involved in returning to the associated utility(s) will be blocked.

- The system will either transfer to the other Utility or to Generator.
- Once the fault has been cleared, when the operator pushes the “Bus Alarm Reset” button at the Master Control Station, the load will transfer back to the reset Main breaker per the applicable sequence.

8.2 Utility Main Breaker Fail to Open

The condition will be annunciated with an audible and visual indicator (i.e. Circuit Breaker Summary Alarm light and *FTO* by the affected breaker on the Oneline).

In general, a fail to open of a main breaker during a manually initiated operation will cause the manually initiated sequence to be aborted. FTO of a Main Breaker on a Utility failure will inhibit all transfers involving that bus.

8.3 Gen Paralleling Breaker (52Gx) Failure to Close

If any generator breaker fails to close that generator will not be available for the system.

- The condition will be annunciated with an audible and visual indicator (i.e. Circuit Breaker Summary Alarm light and *FTC* by the affected breaker on the One-line).

8.4 Gen Paralleling Breaker (52Gx) Failure to Open

- The PLC will monitor the breaker position and if the paralleling breaker has not opened within 2 seconds after a trip command is issued, the condition will be annunciated (visually and audibly) and a relay signal will be issued (available to shunt trip an upstream device if available).
- As long as the generator remains connected to the bus it cannot be shutdown.
- Once removed from the bus, the affected generator will be shutdown.
- The operator shall then place the generator into Lockout/Reset and rack out/service the failed breaker.
- The condition will be annunciated with an audible and visual indicator (i.e. Circuit Breaker Summary Alarm light and *FTC* by the affected breaker on the One-line).

8.5 Lockout of Generator Paralleling Breaker

- If a Generator breaker trips on a Device 86 lockout, the breaker will open and the start signal to the affected generator will be removed immediately.
- The condition will be annunciated with an audible and visual indicator (i.e. Circuit Breaker Summary Alarm light and on the Oneline).

8.5.1 Reset of 86 Lockout condition

Once the condition has been repaired, it must be reset in basically the order the lockout occurred.

- Any protective relay that issued a fault must be reset.
- Any Device 86 Lockout relay must be reset.
- The last step would be to press the “Bus Alarm Reset” button at the Master Control Station.

8.6 PLC Failure

8.6.1 System PLC Redundancy

The master system controller consists of two PLC’s: System PLC-1 and PLC-2.

Any one of the 2 system PLC’s is capable of operating the entire system and being the active controller. The active controller will be annunciated on the OIT. If the active PLC is functioning properly, it shall control all of the Master system functions: Load Adding, Load Shedding, Master system alarms, OIT entry, System Test, etc. The other PLC’s will be in a standby running condition. They perform all of the logic the same as the active PLC with the exception that they will not control any of the output functions (i.e. lights, breaker operations, load control operations, etc.).

If the active PLC fails, there will be a seamless transfer of output control to the next PLC in the sequence. If the failed PLC is repaired and returned to service, it will operate in the standby running condition as described above. These conditions will be annunciated with audible and visual indicators.

8.6.1.1 Total System PLC Failure

In the event that both System PLC’s fail, the system will revert to Manual control. Bus optimization, automatic load add/shed and load demand will be disabled.

Generator PLC’s are separate from the master PLC, so full control of the generators will still be functional.

8.6.2 Generator PLC Redundancy

There is no generator PLC redundancy, but the genset controller is hardwired to function even if the generator PLC is failed. The Generator PLC is used for annunciation and “Test” features only. While normal automatic operation is still available with a failed generator PLC, the following features will be lost:

- Test Offline
- Test Online
- All Engine Malfunction annunciation, except “Common Shutdown”.

8.7 Engine Malfunction Indication

Upon initiation of a malfunction, the generator set will be removed from the bus and shutdown.

Among the shutdown and lockout provided are the following:

Engine Overcrank
Engine Low Water Temperature
Engine High Water Temperature Pre-Alarm
Engine High Water Temperature Shutdown
Engine Low Lube Oil Pressure Pre-Alarm
Engine Low Lube Oil Pressure Shutdown
Engine Overspeed
Reverse Power
Ground Fault Alarm
Low Fuel Day Tank (or Main Tank)
Engine Low Coolant Level
Control switch not in automatic position (Controls not in Auto)
High Battery Voltage
Low Battery Voltage
Battery Charger AC Failure
Remote Emergency Stop
Emergency Stop
Common Alarm
Common Shutdown
Air Shutdown Damper (If Equipped)
Generator Paralleling Circuit Breaker Trip (Over current)
PLC Stopped
Control Voltage Failure
Generator Controller Diagnostic Fault

Audible and visual alarm signals are activated for any of the above malfunctions.

Alarms need to be reset by pressing alarm reset push button on the generator control station. Shutdowns are reset by placing the Generator Control Switch (GCS) to the lockout/reset position.

An audible alarm silence circuit is provided. The audible alarm silence is reset upon reset of the malfunction or upon the occurrence of a malfunction after the alarm has been silenced. The audible alarm will annunciate each malfunction and pre-alarm.

9 Appendix-1 Factory Default Settings

The following is a table of all the parameters, which can be changed via the Operator Interface Terminal (OIT).

Label	Description	Range	Customer Settings
Load Shed Priorities			
52A1	TBD	(101-499)	TBD
52A2	TBD	(101-499)	TBD
52A3	TBD	(101-499)	TBD

Label	Description	Range	Factory Setting	Customer Settings
Minimum Gens (Automatic Transfer after Normal Source Failure)	Minimum generators online requirement before loads are sequenced on to the generator bus	(1-3)	1	
Utility Outage TD	Utility Outage Override time delay	(0-60 sec)	5 sec	
Open Transition TD	Time between breaker operations during open transition transfers	(0-30 sec)	5 sec	
Fail to Open TD	Time delay before action is taken on a breaker fail to open.	(0-10 sec)	2sec	
Utility Return TD	Utility Source Stabilization time delay before transfer to utility.	(0-45 min)	30 min	
Fail to Synchronize	Parallel with Utility fail to Synch	(0-180 sec)	120 sec	
No Power TD	TD before system seeks utility if available or bypasses enough Gens requirement, after sending an engine start and loads have not been powered.	(30-300 sec)	32 sec	
Bus Op Start TD	Bus Optimization Start Time Delay	(0 - 1800 sec)	30 sec	
Bus Op Step TD	Bus Optimization Step Time Delay	(0 - 1800 sec)	5 sec	
Bus Optimization KW	Bus Optimization KW de-rating value	(80-95%)	95%	
Load Demand TD	Load Demand Stabilization Time Delay	(0 - 1800 sec)	30 sec	
2nd Start TD	Start Pri. 2 EG Time Delay	(0 - 1800 sec)	5 sec	
2nd Stop TD	Stop Pri. 2 EG Time Delay	(0 - 1800 sec)	20 sec	
3rd Start TD	Start Pri. 3 EG Time Delay	(0 - 1800 sec)	5 sec	
3rd Stop TD	Stop Pri. 3 EG Time Delay	(0 - 1800 sec)	20 sec	
Generator 1 Pri.	Generator 1 Load Demand Pri. #	(1-6)	1	
Generator 2 Pri.	Generator 2 Load Demand Pri. #	(1-6)	2	
Generator 3 Pri.	Generator 3 Load Demand Pri. #	(1-6)	3	

TD = Time Delay Sec = Seconds Min = Minutes